IEEE Interconnection Standard for Utility-Intertied Photovoltaic Systems Is Approved

An IEEE-sponsored working group has developed an interconnection standard that will simplify the process of interconnecting photovoltaic systems with an electric utility. Photovoltaics (PV) is a solar-electric technology that uses solid-state solar cells to convert solar energy to electric energy. Not only does this standard vastly simplify PV interconnection, but it is the first IEEE standard of its kind for allowing utility interconnections of non-utility-owned distributed generation equipment. The unique aspects of this standard include tightly-defined requirements for the interconnecting hardware that can be tested by an independent test laboratory such as Underwriters Laboratories. This removes former barriers to PV use throughout the country.

John Stevens, Sandia National Laboratories, Albuquerque, New Mexico, chaired the working group, which included about 25 members representing the utility industry, the PV industry, PV inverter manufacturers and PV researchers. The effort was sponsored by IEEE Standards Coordinating Committee 21 (SCC21). It required a little over three years from initial announcement of the project to final approval by the IEEE Standards Board. Its value is that it provides a standard that PV interconnection hardware can be designed to, thus removing the requirement for specialized hardware for different utility jurisdictions. The standard includes very specific requirements for systems of up to 10kW, but it covers systems of all sizes. The IEEE PV interconnection standard, identified as IEEE Std 929-2000, is known informally as IEEE 929.

The standard actually applies to the PV inverter, the device that converts the PV dc energy into utility-compatible ac energy. Similar inverters are used in other distributed generation systems such as fuel cells and microturbines. Many of the requirements for interconnection that are described in IEEE 929 might also be adopted for these other technologies.

IEEE 929 provides guidance for operating voltage and frequency windows, trip times for excursions outside these windows, requirements for waveform distortion, as well as defining a non-islanding inverter. An important parallel effort was performed at Underwriters Laboratories where a test procedure, UL 1741, was written that will verify that an inverter meets the requirements of IEEE 929.

In support of the IEEE 929 process, several development projects were completed at Sandia that addressed interconnection issues. The performance of several inverters operating in parallel when a utility line is de-energized was characterized to better understand the potential for unintended operation during a utility outage ("islanding"). A control scheme was developed to assure that islanding doesn't happen. A test was developed to allow testing of single inverters to identify the presence, or lack, of an adequate anti-islanding scheme. Several specific tests were performed at the request of some electric utilities to examine such issues as ferroresonance with inverters under fault conditions and response of inverter protection schemes to the non-sinusoidal waveforms that are sometimes associated with abnormal conditions on utility systems.

This working group was an outstanding example of people with different backgrounds working together toward a common goal -- simplifying the interconnection procedure. IEEE SCC21, which is chaired by Dick DeBlasio of the National Renewable Energy Laboratory, has sponsored numerous PV-related standards since its inception in the late 1970s.

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